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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>C11D 1/02, 1/83, 1/831, 1/94, 3/37</b>		<b>A1</b>	(11) International Publication Number: <b>WO 97/45510</b>
			(43) International Publication Date: <b>4 December 1997 (04.12.97)</b>
(21) International Application Number: <b>PCT/US97/08984</b>			(81) Designated States: AU, CA, JP, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(22) International Filing Date: <b>28 May 1997 (28.05.97)</b>			
(30) Priority Data: <b>60/018,651</b> <b>30 May 1996 (30.05.96)</b> <b>US</b>			
(60) Parent Application or Grant (63) Related by Continuation <b>US</b> <b>60/018,651 (CIP)</b> <b>Filed on</b> <b>30 May 1996 (30.05.96)</b>			
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(54) Title: <b>FOAMING ACIDIC DETERGENT/CLEANSING GEL</b>			
(57) Abstract  An acidic cleansing gel having a desirable viscous gel texture, excellent foaming/cleansing detergency, exceptional mildness, good rinse-off characteristics, and/or effective solid surface wetting on substrates. The cleansing gel includes surfactants that are preferably of amphoteric or nonionic types and inorganic, organic and/or polyelectrolyte acid to acidify the gel and gelling agents made up of water swellable/soluble anionic, cationic or nonionic polysaccharides or synthetic cationic, anionic, or nonionic polymer types which are combined in a ratio to enable ionic, hydrophobic and hydrogen bonded associative interpolymer gel networks.			

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## FOAMING ACIDIC DETERGENT/CLEANSING GEL

This is a continuation-in-part application of my pending United States Provisional application, Application Serial No. 60/018,651 filed May 30, 1996 entitled "Foaming Acidic Detergent/Cleansing Gel."

### INCORPORATION BY REFERENCE

5 United States Provisional Application, Serial No. 60/018,651 filed May 30, 1996 entitled "Foaming Acidic Detergent/Cleansing Gel" is incorporated herein by reference.

This invention pertains to the formation of cleansing gels and, more particularly, to acidic cleansing gels having a desirable viscous gel texture, excellent foaming/cleansing detergency, exceptional mildness, good rinse-off characteristics, and effective solid surface wetting on  
10 substrates such as skin, fibers, metal, glass/ceramic.

### BACKGROUND OF THE INVENTION

Alkali saponified fats or oils, i.e. soaps, have historically been the fundamental cleansing agent until the early to mid 20th century. Soaps, although good foamers, are chemically reactive with divalent metals, which are often present in ground water sources, resulting in a reduction of  
15 the soap's detergency and also resulting in the depositing of insoluble Ca or Mg soaps, commonly known as "soap scum," on solid surfaces. More recently, synthetic anionic detergents, e.g. alkyl, alkyl ether, alkyl benzene, and alpha olefin sulfates or sulfonates have replaced soap in most cleansing/detergent products since these anionic detergents have superior detergency in nearly all types of water. These anionic detergents are relatively inexpensive and can be easily formulated  
20 with additives to enhance foaming, viscosity, surface conditioning, or specific performance

features such as germicidal and bleaching activity. In addition, these anionic detergents are compatible with hypochlorites. The deficiencies of these detergents lay in their anionic and alkaline nature. These detergents are harsh to biological barriers and can cause skin and eye irritation. These detergents are also incompatible with cationic actives such as quaternary surfactants or polymeric fiber/skin conditioners or biocides and lose detergency/stability in moderate - to - highly acidic solutions. To improve the mildness of skin cleansers, a blend of low critical micellar concentration, CMC, (generally nonionic and amphoteric types) with high CMC (alkyl sulfate or olefin sulfonate anionic types) surfactants has been added to anionic detergents. U.S. Patent No. 3,223,647, assigned to P&G, discloses a synergistic mildness to the skin cleanser when amine oxides are blended with more irritating surfactants. United States Patent No. 5,290,471, to Green et al., discloses skin cleansing formulas incorporating surfactant blends predominated by fatty esters of isethionic acid (low CMC anionic surfactant) and other anionic and amphoteric surfactants. United States Patent No. 5,503,779, to Adamy et al., discloses a high foaming, mild light duty liquid detergent composition containing a blend of alkyl ether sulfate anionic surfactant, two glucoside nonionic surfactants, two zwitterionic betaine surfactants, and a hydrophobic nonionic surfactant.

Several nonionic and amphoteric surfactants have found applications in mild or acidic product niches, but foaming/cleansing and product viscosity are compromised. United States Patent No. 3,055,836, to Masci et al., and 3,950,417, to Verdicchio et al., discloses a mild, non-irritating shampoo formulation containing nonionic and amphoteric surfactants for mildness. This shampoo requires an anionic/amphoteric surfactant mixture, e.g. sodium salt of an alkyl ether

sulfate, to produce the desired foaming. In the '417 patent, it is disclosed that low eye irritation resulting from the addition of nonionic surfactant Polysorbate 20 and that the nonionic surfactant resulted in a drastic decrease in foaming and viscosity - two benchmarks by which consumers judge the shampoo's performance.

5           Additionally, polymeric ingredients have been formulated into shampoos, skin cleansers, and other foaming products to improve mildness, foam quality, and conditioning. Goddard in "Applications of Polymer-Surfactant Systems," Interactions of Surfactants with Polymers and Proteins, ed. E.D. Goddard and K.P. Ananthapadmanabhan, CRC Pub. 1993; discloses that the presence of polymer aggregates of surfactant can form at concentrations lower than CMC and that  
10           lowered monomer concentrations of the surfactant can correspond to lower irritation. United States Patent No. 4,228,277, to Landoll, discloses that a group of modified nonionic cellulose ethers possess sufficient foam stabilizing activity for their usefulness in personal care foams. The adsorption of quaternized derivatized polysaccharides onto hair fibers for conditioning purposes is disclosed in United States Patent No. 3,472,840 to Stone et al. and United States Patent No.  
15           3,589,978 to Kamal.

          Anionic surfactants, e.g. sulfate or sulfonate detergents, still play a predominant role in cleaning/cleansing products due to good foaming properties, despite their harshness, poor rinsing, and physicochemical incompatibility with acidic or cationic functional ingredients. However, anionic detergents tend to absorb onto the solid surfaces they clean and leave a significant anionic  
20           or negative electrical charge which is particularly noticeable on fibers (natural or synthetic), skin, hair and non-conductive surfaces (glass and plastics). This condition results in the formation of a

rough or a raised surface texture and leads to strong triboelectric charges on these surfaces causing "static cling" in fibers, uncontrollable/"flyaway" hair, and an annoying, sometimes dangerous, buildup of electrical charges on non-conductive surfaces.

To combat the charge buildup on fibers, "anti-static or conditioner" post cleaning products have been developed. These products are typically acidic dispersions of alkyl quaternary ammonium salts and a hydrophobic film former (e.g. fatty alcohols, ester, ether or hydrophobic polymer) and can be thickened with a "long chain alkylated water-soluble polymer" as taught in United States Patent No. 5,104,646 by Bolich et al. Additionally, sterically isolated cationic/lipophilic conditioners suspended or emulsified in anionic detergents used in "2 in 1" hair, skin or fabric cleaners are presently used to counter the static charge build-up on textiles, hair, skin, and many non-conductive surfaces. United States Patent Nos. 3,533,955 by Pader et al.; 4,364,837 by Pader; 4,788,006 and 4,902,499 by Bolich et al; and J.P. 2,262,507 by Imaki et al. teach that the use of cationic and/or hydrophobic surfactants with silicone polymers absorb onto the negatively charged synthetic or raised keratin surfaces. These absorbed agents neutralize and counteract these undesirable static charges or mitigate via surface coating rough skin or fiber surfaces caused by cleaning with alkaline to mildly acidic solutions of anionic detergents. The resultant effect is that high foaming anionic detergent formulas clean the surface (skin, hair, fiber, or non-conductive solid) but require an adsorptive treatment to smooth and reduce static charge. These adsorptive treatments cover up the defective washed surface, eventually building up upon repeated use thereby resulting in heavy or matted, water repellant, dull, and coarse textured hair or fiber.

Therefore, a need exists for a thickened, good foaming, moderately - to - mildly acidic detergent/cleansing product that gently cleans and, and for fibrous surfaces also leaves the cleansed solid surface healthy, smooth, soft, conditioned and nearly static free with little adsorptive buildup.

### SUMMARY OF THE INVENTION

5           The present invention pertains to the formation of acidic cleansing gels. The cleansing gels are preferably thickened, good foaming, acid compatible cleaning/cleanser liquid suspensions. The acidic cleaning gels have a desirable viscous gel texture, excellent foaming and cleansing detergency, exceptional mildness, good rinse off characteristics, effective solid surface wetting on substrates such as skin, fibers, metal, glass and ceramics, forms little adsorptive buildup and leaves  
10       a near neutral net charge (static free).

          In accordance with the principal feature of the present invention, the acidic cleansing gel include amphoteric or nonionic surfactants, an acid and a gelling agent forming an associative interpolymer gel network. The acidic cleansing gels have increased fluid viscosity, enhanced foam quality/quantity, improved surface rinsing, excellent surface wetting or conditioning, heightened  
15       mildness yet effective cleaning as compared to current mild cleansers/detergent preparations.

          In accordance with another aspect of the present invention, the acidic cleansing gels are preferably an amphoteric or nonionic gel acidified to a pH of less than about 7 and more preferably, less than about 5. The acidic cleansing gel is preferably acidified by an inorganic, organic and/or polyelectrolyte acid.

20           In accordance with yet another aspect of the present invention, the gelling agents preferably are combinations of water swellable/soluble anionic, cationic, or nonionic polysaccharides (natural

or synthetically derivatized) and/or synthetic cationic, anionic, or nonionic polymer types. Preferably, the gelling agents are combined in a ratio to enable limited ionic and hydrogen bonded associated interpolymer gel networks. Strong bonding of these types would result in polymer precipitation. It is believed that defined combinations of water soluble polysaccharides and synthetic polymers maximize thickening, foam stability, cleansing, and mildness via a predominance of hydrophobic polymer-polymer and polymer-surfactant interactions or associations. These gel networks improve fluid viscosity by maintaining a gel structure in harsh acidic, and highly ionic solutions compared to non-associative polymeric networks; and are compatible with most detergents, forming weak complexes with the surfactants enhancing mildness and improving foam structure/stability. Preferably, the gel networks are not precipitated or hydrolyzed in an acidic solution.

In accordance with another aspect of the present invention, the cleansing gels include functional additives for solid surface cleaning. Such functional additives include the addition of ionic surfactants, enzymes, strong acids, etc.

The primary object of the present invention is the provision of a cleansing gel having a desirable viscous gel texture, excellent foaming qualities, excellent cleansing detergency, exceptional mildness, desirable rinse-off characteristics, and effective solid surface wetting.

Another object of the present invention is the provision of a cleansing gel which forms little adsorptive buildup.

Yet another object of the present invention is the provision of a cleansing gel which leaves a near neutral net charge on the surface of a cleansed substrate.



Still yet another object of the present invention is the provision of a cleansing gel which provides the desired cleansing and conditioning of fibers without the need for conditioning and/or anti-static additives.

These and other objects and advantages will become apparent to those skilled in the art upon the reading of the following description.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

The cleansing gel is a thickened, good foaming, acid compatible cleaning/cleanser liquid suspension or gel. The cleansing gel preferably contains amphoteric and/or nonionic surfactants, an acid, a water swellable/soluble polysaccharide, synthetic hydrophilic and/or amphipathic polymer mixture forming an associative interpolymer gel network. The cleansing gels may also include various functional additives for solid surface cleaning. The surfactants in the cleansing gels are present in an amount of about 0.2 to about 40 percent by weight of the gel. Preferably, the surfactant concentration is about 2 to about 15 weight percent for slightly diluted applications (1-10x) and preferably about 8 to about 25 weight percent for highly diluted applications (> 10x). Dilution is measured by the amount of gel to the amount of liquid (typically water) in the type of application. The primary surfactant component is preferably an amphoteric and zwitterionic surfactant such as, but not limited to, alkyl, alkyl dimethyl, alkylamido, alkyl amide, alkylamidopropyl, or alkyl dimethyl ammonium betaine; alky amidopropyl or alkyl sulfobetaine; alkyl, alkylampho, or alkylamphocarboxy glycinate; alkyl, or alkyl substituted imidazoline mono- or di-carboxylate; sodium salts of alkyl mono- or dicarboxylates; alkyl beta amino acids; alkyl amidopropyl, or alkyl ether hydroxysultaine; alkyl amidopropyl dimethyl ammonia acetate; alkyl

ampho mono- or diacetate; alkyl, or alkyl ampho, or alkyl imino dipropionate; alkyl  
amphopropionate; alkyl beta amino propionic acid; alkyl dipropionate; alkyl beta  
iminodipropionate; branched or n-alkyl dimethylamidopropionate; alkyl carboxylated propionate;  
alkyl, or methyl alkyl imidazoline; fluorinated alkyl amphoteric mixtures; and/or nonionic  
5 surfactants such as, but not limited to, alkyl, alkyl dimethyl, alkyl amidopropylamine, or bis 2-  
hydroxy ethyl alkyl amine oxides; alkanolamides; alkyl superamides; polyoxyethylene glycol  
(PEG) of monoglycerides, of sorbitan esters, of branched or linear fatty alcohol ethers, of branched  
or linear fatty acid ethers, of thioethers; alkyl oxoalcohol PEG; PEG fatty esters; polyoxyethylene  
glycol/polyoxypropylene glycol block copolymers; alkyl phenol PEG ethers; alkyl polyglucosides,  
10 or polysaccarides; and polysiloxane polyethoxylene ether. These surfactants are the principle  
detergents incorporated into the cleansing gel.

A secondary surfactant may be added to the cleansing gel. The secondary surfactant may  
be an ionic detergent such as, but not limited to, anionic detergents, alkyl ether carboxylate,  
phosphate, or sulfate; metallic or ammonium salts of mono-/di-alkyl sulfo succinate; sodium alkyl  
15 benzene or alpha-olefin sulfonate; sodium alkyl methyl taurate; acyl sarcosine or sarcosinate; alkyl  
esters of glutamic or isethionic acid, or their salts. Also cationic detergents of mono-, di-, and tri-  
alkyl quaternary ammonium salts, alkyl benzyl dimethyl quaternary ammonium salts, polyglycol  
(e.g. polypropoxylated) quaternary ammonium salts, alkyl or alkyl polyglycol (e.g. polyethylene  
oxide) fatty amines or diamines, tetraalkylammonium salts (e.g. alkyl trimethyl quaternary  
20 ammonium methosulfates or acetates, dialkyl ethoxylated dimethyl quaternary ammonium salts),  
heterocyclic ammonium salts (e.g. alkyl amidoamines, pyridinium, or imidazoline salts), amino

functional polysiloxanes with or without fatty acid condensates, polyamine condensates, or DL-pyrrolidone carboxylic acid salts of N, N, alkyl L-arginine ethyl esters. If an ionic detergent is used, the detergents are present in an amount less than about 20% by weight of the gel and preferably less than about 5% by weight. The secondary surfactant is preferably added to the gel in  
5 an amount which is less than the amount of the primary surfactant in the gel.

The acid in the cleansing gel typically makes up at least about 0.01 wt.% of the gel and preferably about 0.05 to about 60 wt.% and more preferably about 0.3 to about 15 wt. %. The acid includes organic, inorganic, and/or polyelectrolyte acids. The acids which can be used in the cleansing gel include, but are not limited to, inorganic acids such as hydrochloric, hypochlorous,  
10 hydrobromic, boric, nitric, nitrous, hypophosphorous, phosphoric, sulfuric, sulfurous and/or sulfamic acids; organic alkyl/aryl carboxylic or dicarboxylic acids such as carbonic, formic, acetic, chloroacetic, propionic, butyric, benzoic, adipic, and/or succinic; and/or organic hydroxyl-alkyl/aryl carboxylic or dicarboxylic acids such as hydroxyacetic, lactic, malic, tartaric, citric, and/or salicylic acids and/or polyelectrolytes or polycarboxylic acids (e.g. polyacrylic,  
15 acrylic/maleic acid copolymers). The acid is added to the cleansing gel to cause the gel to have a pH of less than 7 and more preferably less than about 5. The acid or acids incorporated into the gel are selected depending on the application of the gel.

The cleansing gel is thickened into a fluid to semi-solid viscous gel by the use of a binary or ternary blend of cationic, anionic, nonionic, or hydrophobically modified types, water  
20 swellable/soluble polymers. The gelling agents are preferably added in an amount of about 0.5 to about 10 wt.% of the cleansing gel and more preferably, about 0.1 to about 5 wt.% and more

preferably, about 0.1 to about 2 wt.%. The blend of polymer is combined into water or water miscible polar solvents, in a manner familiar to those with the art. At defined ratios, these blends form intermolecular associative structures through ionic, hydrophobic, or hydrogen bonding. These associating polymer networks remain soluble or dispersible in the solvent to form an efficient thickened dispersion or gel structure. These thickened fluid structures enable the formation of stable networks in highly acidic and ionic solutions without the loss of fluid viscosity due to polymer precipitation or hydrolysis during extended storage at ambient and elevated (40°C) temperature.

Water swellable/soluble cationic polymers that can be used to include quaternized polysaccharides such as trimethyl ammonium substituted epoxide of hydroxyethylcellulose, diallyldimethyl ammonium salts of hydroxyethylcellulose, deacylated chitin or chitosan, dihydroxypropyl chitosan trimonium chloride, hydroxypropyltrimethyl ammonium chloride guar, locust bean, or konjac mannan gum; quaternized synthetics such as acrylamide dimethyl diallyl ammonium chloride copolymers, acrylamide/dimethyl diallyl ammonium chloride/acrylic acid terpolymer, quaternized poly (vinyl pyrrolidone/dimethyl amino ethyl-methacrylate), poly (vinylpyrrolidone/methacrylamidopropyl trimethylammonium chloride), polyvinyl pyrrolidone/methylvinyl-imidazolinium chloride or methyl sulfate copolymer, chloroethylether/dimethylaminopropyl-amine/adipate or azelate terpolymer, vinylpyrrolidone/methacrylamido-propyl trimethylammonium chloride, acrylonitrile/acrylic acid/dimethylpropanediammonium acrylates sulfate terpolymer. These polymer aggregates bond interpolymerically via ionic, hydrogen, or hydrophobic bonding with water swellable/soluble;

anionic or nonionic polysaccharide polymers such as gum tragacanth, sodium or propylene glycol alginate, kappa-, iota-, or lambda-carrageenan, guar or hydroxy propyl guar gum, karaya gum, gum arabic, locust bean gum, konjac mannan gum, gellan, xanthan, succinoglycan or its acidic or enzymatic hydrolysates, sodium carboxymethyl cellulose, methycellulose, hydroxyethylcellulose, hydroxypropylmethylcellulose, and hydroxypropylcellulose; and/or hydrophobically modified anionic, cationic, or nonionic polymers such as, but not limited to, alkyl and/or aryl substituted hydroxyethylcellulose, lauryl dimethyl ammonium substituted epoxide of hydroxyethylcellulose, propoxylated cellulosic, xanthan, succinoglycan, or polygalactomannoses, alkyl methacrylates/crosslinked acrylic acid copolymer and/or acrylonitrile/acrylates block copolymer.

The ratio of cationic to anionic and/or nonionic polymers is about 0.001:10 to about 5:1 and more preferably about 0.5:5 to about 3:2. The ratio of anionic and nonionic to hydrophobically modified anionic and nonionic is preferably about 1:5 to about 8:1. The polymers are combined and dispersed into an acidic buffered solution in a manner familiar to those in the art of water swellable/soluble polymer compounding to obtain a single phase, homogeneous viscous dispersion. The precise selection of oppositely charged polymer chemistries is important to obtained controlled intrepolymer association without resulting in precipitation or a multiphase separation. The type and concentration of hydrophobically modified anionic or nonionic are determined by their interaction with the concentrated surfactant micellar solution of the detergents in the formulation.

The following examples are exemplary of the wide number of uses for the cleansing gel.

**EXAMPLE 1: LIQUID LAUNDRY DETERGENT FOR COLOR PROTECTION AND DELICATE FABRICS**

	10.0 wt. %	Citric Acid
5	14.0 wt. %	Amphoterge J-2, 50% solids (Lonza Chem.)
	4.0 wt. %	Propylene glycol
	4.5 wt. %	Varisoft 432-CG, 68% solids (Witco)
	10.0 wt. %	Tergitol 15-S-7, 100% solids (Union Carbide)
	0.1 wt. %	Rhodicare Xanthan Gum (Rhone-Poulenc)
	0.3 wt. %	N-Hance 3000 Cationic Guar Gum (Aqualon)
10	0.6 wt. %	Enzymes: Termamyl 300L DX and Savinase 16L DX (Novo Nordisk)
	balance	Deionized water
	q.s	NaOH to pH 5.0

The laundry detergent is formed by dispersing the gums in water in manner typical for these thickeners. The citric acid is dissolved in water and then the gum mixture is added to the dissolved citric acid. The glycol, surfactants, alkali, and enzymes and then add to slightly thickened citric acid solution. The ratio of cationic to anionic polymers in the laundry detergent is about 3:1. This liquid detergent gently, yet effectively, cleans the most delicate colored fabrics, leaving the fabric clean yet soft.

**EXAMPLE 2: AEROSOL "NON-SOAP" SHAVE FOAM FOR SENSITIVE SKIN**

	72.0 wt. %	Deionized water
	6.1 wt. %	Mackam ISA, 33% solids (McIntyre Chem.)
	1.0 wt. %	Mackam IC, 45% solids (McIntyre Chem.)
25	3.6 wt. %	Glucopon 600CS, 50% solids (Henkel Chem.)
	10.0 wt. %	Sorbitol, USP
	0.2 wt. %	Ucare Polymer JR40M (Union Carbide Chem.)
	0.2 wt. %	Jaguar HP-120 (Rhone-Poulenc Chem.)
	0.1 wt. %	Carrageenan (TIC Gum)
	2.5 wt. %	Lactic acid, 88% FCC
30	0.8 wt. %	Triethanolamine, >99% purity
	3.5 wt. %	Aerosol Propellant A-46

The shave form is formed by dispersing the polymers and gums into water in manner typical to these thickeners. Sorbitol, surfactants are then added and evenly mixed into gel. The acid and amine finally are added and then charged into an aerosol container with propellant. The ratio of cationic to anionic polymers in the shave foam is about 2:1. The ratio of anionic to hydrophobically modified anionic polymer is about 1:2. The shave foam has a pH 3.9 - 4.1, has a stable rich foam upon dispensing, causes less irritation than alkali soap save foams and gels, has better lubricity on skin surface for razor glide, and has improved softening of facial or body hair for ease of shaving.

### EXAMPLE 3: MILD CONDITIONING SHAMPOO

10	44.2 wt. %	Deionized water
	34.5 wt. %	Mirataine CB, 35% solids (Rhone - Poulenc)
	6.0 wt. %	Plantareen 2000, 50% solids (Henkel)
	10.0 wt. %	Propylene Glycol
	3.0 wt. %	Citric acid, FCC
15	1.0 wt. %	Aminomethylpropanol, 95% (ANGUS)
	0.2 wt. %	Keltrol RD (Kelco)
	0.4 wt. %	Ucare Polymer JR40M (Union Carbide Chem.)
	0.2 wt. %	N-Hance HP-40 (Hercules Chem.)
	0.5 wt. %	Preservative

20 The shampoo is formed by dispersing Keltrol, Ucare, and N-Hance polymers into water in manner appropriate to methods used by those familiar in the art. Glycol, detergents, and acid are then added and slowly mixed together. Finally, the amine and preservative is added to the solution. The ratio of cationic to anionic polymer in the shampoo is about 2:1. The ratio of anionic to hydrophobically modified polymer in the shampoo is about 1:1. The shampoo has a pH 3.5-3.8; which is at the isoelectric point of hair keratin. The shampoo effectively cleans hair

without leaving the hair fibers having a strong anionic charge, unmanageable, and harsh to the touch if shampooing with anionic detergents.

	<u>COMPOSITION</u>	<u>VISCOSITY (cps.)*</u>	<u>FOAM DRAIN TIME (sec.)+</u>
5	Example 3. Mild conditioning shampoo	1800	25
10	Mild conditioning shampoo without polymers (Keltrol RD, Ucare Polymer JR40M, & N-Hance HP-40)	<50	13
15	*Brookfield Rotoviscometer LVT (0.5 rpm.) +Method: J.R. Hart and M.T. DeGeorge, "The Lathering Potential of Surfactants - a Simplified Approach to Measurement", <u>J. Soc. Cosmetic Chem.</u> 31, 223-236 (Sept./Oct. 1980)		

#### EXAMPLE 4: ANTI-BACTERIAL MILD SKIN CLEANSER

	20.0 wt. %	Mackam 35, UL, 35% solids (McIntyre)
	8.0 wt. %	Plantaren 2000, 50% solids (Henkel)
20	10.0 wt. %	Propylene Glycol
	0.4 wt. %	Rhodicare Gum (Rhône-Poulenc)
	0.4 wt. %	Jaguar HP-105 Gum (Rhône-Poulenc)
	0.4 wt. %	Lactic Acid, 70%, USP
	0.25 wt. %	Hyamine 1622, (Lonza)
	0.1 wt. %	Versene Acid (Dow)
25	balance	Deionized Water

The skin cleanser is formed by dispersing the gums in eionized water. Surfactants, glycol, acids and Hyamine, benzethonium chloride are then mixed with the gums. The ratio of anionic to hydrophobically modified polymer in the skin cleanser is about 1:1. The slightly acid hand or skin



cleanser forms a thick, rich foam which effectively cleans the skin and further deposits an anti-bacterial quaternary ammonium agent on the surface of the skin.

#### EXAMPLE 5: FOAMING ACIDIC LIQUID BATHROOM CLEANER

2.0 wt. %	Hampoyl C, 100% solids (Hampshire Chem.)
2.5 wt. %	Mackamine CO, 30% solids (McIntyre)
6.0 wt. %	Arcosolv DPTB (ARCO Chem.)
0.6 wt. %	Carbopol 1610 (BFGoodrich)
1.0 wt. %	NaOH (10 wt. % solution)
1.0 wt. %	Gafquat HS-100 (ISP), 20% solids (ISP)
1.0 wt. %	citric acid
balance	deionized water

The bathroom cleaner is formed by combining water with propylene glycol ether and then dispersing Carbopol into the ether solution and rapidly agitate the solution. The solution is then neutralized by the addition with NaOH. Water, Gafquat, Hampoyl C and Mackamine CO surfactants are then added until a homogeneous mixture is formed. Finally, the mixture is thickened by the addition of propylene glycol ether/water solution and then acidifying the solution with citric acid. The ratio of cationic to anionic polymer in the bathroom cleaner is about 1:3. This moderately thickened sprayable, acidic, detergent solution contains chelating acids and an oily dirt dissolving solvent that readily cuts bathroom surface mineral and organic soils, yet is mild when in contact with the skin.

**EXAMPLE 6. ACIDIC TOILET BOWL DISINFECTING CLEANER GEL**

0.7 wt. %	Natrosol Plus 330 CS (Hercules Chem.)
0.7 wt. %	Ticaxan Technical grade (TIC Gum)
2.0 wt. %	Makon 12 100% solids (Stepan Chem.)
7.0 wt. %	Ammonyx LO, 30% solids (Stepan Chem.)
4.0 wt. %	BTC 885m 50% actives (Stepan Chem.)
25.0 wt. %	Hydrochloric Acid (38%)
60.6 wt. %	Deionized water

The toilet bowl cleaner is formed by combining dry resin and gum in water using rapid agitation until fully dispersed. The remaining ingredients are then added and mixed together by slow agitation of the solution. The ratio of an ionic to hydrophobically modified polymer in the toilet bowl cleaner is about 1:1. The thickened toilet bowl cleaner has a viscosity of approximately 1500 cps., and can be easily dispensed from a squeeze bottle. The cleaner has sufficient yield strength to cling to vertical portions of a ceramic toilet bowl.

The invention has been described with reference to a preferred embodiments and alternates thereof. It is believed that many modifications and alterations to the embodiments discussed herein will readily suggest themselves to those skilled in the art upon reading and understanding the detailed description of the invention. It is intended to include all such modifications and alterations in so far as they come within the scope of the present invention.

We claim:

1. A gel composition comprising:

a) about 0.2 to about 40% by weight primarily surfactant consisting essentially of an amphoteric surfactant, nonionic surfactant and mixtures thereof;

5 b) at least about 0.01% by weight acid to reduce the pH of said cleansing gel below about 7;

c) at least about 0.05% by weight a water swellable/soluble polymer mixture consisting essentially of a polysaccharide polymer, synthetic hydrophilic polymer, amphipathic polymer and mixture thereof; and,

10 d) water.

2. A gel composition as defined in claim 1, wherein said surfactant is about 0.2 to about 40% by weight of said gel composition.

3. A gel composition as defined in claim 2, wherein said surfactant is less than or equal to about 0.2 to about 30% by weight of said gel composition.

4. A gel composition as defined in claim 3, wherein said surfactant is about 2 to about 15% by weight of said gel composition when the ratio of solid components to liquid components in said gel composition is up to about 1:10.

5. A gel composition as defined in claim 3, wherein said surfactant is about 8 to about 25% by weight of said gel composition when the ratio of solid components to liquid components in said gel composition exceeds about 1:10.

6. A gel composition as defined in claim 1, wherein said surfactant includes an amphoteric surfactant selected from the group consisting essentially of alkyl, alkyl dimethyl, alkylamido, alkyl amide, alkylamidopropyl, or alkyl dimethyl ammonium betaine; alkyl amidopropyl or alkyl sulfobetaine; alkyl, alkylampho, or alkylamphocarboxy glycinate; alkyl, or  
5 alkyl substituted imidazoline mono- or di-carboxylate; sodium salts of alkyl mono- or dicarboxylates; alkyl beta amino acids; alkyl amidopropyl, or alkyl ether hydroxysultaine; alkyl amidopropyl dimethyl ammonio acetate; alkyl ampho mono- or diacetate; alkyl, or alkyl ampho, or alkyl imino dipropionate; alkyl amphopropionate; alkyl beta amino propionic acid; alkyl dipropionate; alkyl beta iminodipropionate; branched or n-alkyl dimethylamidopropionate; alkyl  
10 carboxylated propionate; alkyl, or methyl alkyl imidazoline; fluorinated alkyl amphoteric mixtures and mixtures thereof.

7. A gel composition as defined in claim 1, wherein said surfactant includes a nonionic surfactant including a surfactant selected from the group consisting essentially of alkyl, alkyl dimethyl, alkyl amidoopropylamine or bis 2-hydroxy ethyl alkyl amine oxides; alkanolamides; alkyl superamides; polyoxyethylene glycol (PEG) of monoglycerides, of sorbitan esters, of  
5 branched or linear fatty alcohol ethers, of branched or linear fatty acid ethers, of thioethers; alkyl

oxoalcohol PEG; PEG fatty esters; polyoxyethlyene glycol/polyoxypropylene glycol block copolymers; alkyl phenol PEG ethers; alkyl polyglucosides, or polysaccarides; polysiloxane polyethoxylene ether and mixtures thereof.

8. A gel composition as defined in claim 6, wherein said surfactant includes a nonionic surfactant including a surfactant selected from the group consisting essentially of alkyl, alkyl dimethyl, alkyl amidoopropylamine or bis 2-hydroxy ethyl alkyl amine oxides; alkanolamides; alkyl superamides; polyoxyethylene glycol (PEG) of monoglycerides, of sorbitan esters, of  
5 branched or linear fatty alcohol ethers, of branched or linear fatty acid ethers, of thioethers; alkyl oxoalcohol PEG; PEG fatty esters; polyoxyethlyene glycol/polyoxypropylene glycol block copolymers; alkyl phenol PEG ethers; alkyl polyglucosides, or polysaccarides; polysiloxane polyethoxylene ether and mixtures thereof.

9. A gel composition as defined in claim 1, including a secondary surfactant, said secondary surfactant less than about 10% by weight of said gel composition and said weight percent of said secondary surfactant being less than the weight percent of said primary surfactant.

10. A gel composition as defined in claim 9, wherein said secondary surfactant is less than about 5% by weight of said gel composition.

11. A gel composition as defined in claim 9, wherein said secondary surfactant includes an anionic surfactant, said anionic surfactant including a surfactant consisting essentially of anionic detergents, alkyl ether carboxylate, phosphate, or sulfate; metallic or ammonium salts of mono-/di-alkyl sulfo succinate; sodium alkyl benzene or alpha-olefin sulfonate; sodium alkyl methyl taurate; acyl sarcosine or sarcosinate, alkyl esters of glutamic, isethionic acid and mixtures thereof.

12. A gel composition as defined in claim 9, wherein said secondary surfactant includes a cationic surfactant, said cationic surfactant including a surfactant consisting essentially of mono-, di- and tri-alkyl quaternary ammonium salts, alkyl benzyl dimethyl quaternary ammonium salts, polyglycol (e.g. polypropoxylated) quaternary ammonium salts, alkyl or alkyl polyglycol (e.g. polyethylene oxide) fatty amines or diamines, tetraalkylammonium salts (e.g. alkyl trimethyl quaternary ammonium methosulfates or acetates, dialkyl ethoxylated dimethyl quaternary ammonium salts), heterocyclic ammonium salts (e.g. alkyl amidoamines, pyridinium, or imidazoline salts), amino functional polyalloxanes with or without fatty acid condensates, polyamine condensates, or DL-pyrrolidone carboxylic acid salts of N, N, alkyl L-arginine ethyl esters and mixtures thereof.

13. A gel composition as defined in claim 11, wherein said secondary surfactant includes a cationic surfactant, said cationic surfactant including a surfactant consisting essentially of mono-, di- and tri-alkyl quaternary ammonium salts, alkyl benzyl dimethyl quaternary

ammonium salts, polyglycol (e.g. polypropoxylated) quaternary ammonium salts, alkyl or alkyl polyglycol (e.g. polyethylene oxide) fatty amines or diamines, tetraalkylammonium salts (e.g. alkyl trimethyl quaternary ammonium methosulfates or acetates, dialkyl ethoxylated dimethyl quaternary ammonium salts), heterocyclic ammonium salts (e.g. alkyl amidoamines, pyridinium, or imidazoline salts), amino functional polyalloxanes with or without fatty acid condensates, polyamine condensates, or DL-pyrrolidone carboxylic acid salts of N, N, alkyl L-arginine ethyl esters and mixtures thereof.

14. A gel composition as defined in claim 1, wherein said acid is about 0.05 to about 60% by weight of said gel composition.

15. A gel composition as defined in claim 14, wherein said acid is about 0.3 to about 15% by weight of said gel composition.

16. A gel composition as defined in claim 1, wherein said acid consists essentially of organic acids, inorganic acids, polyelectrolyte acids and mixtures thereof.

17. A gel composition as defined in claim 16, wherein said inorganic acid including an inorganic compound selected from the group consisting essentially of hydrochloric, hypochlorous, hydrobromic, boric, nitric, nitrous, hypophosphorous, phosphoric, sulfuric, sulfurous, sulfamic acids, polyelectrolytes and mixtures thereof; said organic acid including an organic compound

5 selected from the group consisting essentially of organic alkyl/aryl carboxylic or dicarboxylic acids, organic hydroxyl-alkyl/aryl carboxylic or dicarboxylic acids and mixtures thereof, said organic alkyl/aryl carboxylic or dicarboxylic acid including an acid selected from the group consisting essentially of carbonic, formic, acetic, chloroacetic, propionic, butyric, benzoic, adipic, succinic acids and mixtures thereof, said organic hydroxyl-alkyl/aryl carboxylic or dicarboxylic  
10 acid including an acid selected from the group consisting essentially of hydroxyacetic, lactic, malic, tartaric, citric and/or salicylic acids, said polyelectrolytes including an acid selected from the group consisting essentially of polycarboxylic acids.

18. A gel composition as defined in claim 1, wherein said water swellable/soluble polymer mixture is about 0.05 to about 10% by weight of said gel composition.

19. A gel composition as defined in claim 18, wherein said water swellable/soluble polymer mixture is about 0.1 to about 5% by weight of said gel composition.

20. A gel composition as defined in claim 1, wherein said water swellable/soluble polymer mixture consists essentially of quaternized polysaccharide polymers, quaternized synthetic polymers, anionic or nonionic polysaccharide polymers, hydrophobically modified polymers and mixtures thereof.



21. A gel composition as defined in claim 20, wherein said water swellable/soluble polymer mixture includes a quarternized polymer selected from the group consisting essentially of trimethyl ammonium substituted epoxide of hydroxyethylcellulose, diallyldimethyl ammonium salt of hydroxyethylcellulose, deacylated chitin or chitosan, dihydroxypropyl chitosan trimonium chloride, hydroxypropyltrimethyl ammonium chloride guar, locust bean, konjac mannan gum and mixtures thereof.

22. A gel composition as defined in claim 20, wherein said water swellable/soluble polymer mixture includes a quarternized synthetic polymer consisting essentially of acrylamide dimethyl diallyl ammonium chloride copolymers, acrylamide/dimethyl diallyl ammonium chloride/acrylic acid terpolymer, quaternized poly (vinyl pyrrolidone/dimethyl amino ethyl-methacrylate), poly (vinylpyrrolidone/methacrylamidopropyl trimethylammonium chloride), polyvinyl pyrrolidone/methylvinyl-imidazolinium chloride or methyl sulfate copolymer, chloroethylether/dimethylaminopropyl-amine/adipate, azelate terpolymer, vinylpyrrolidone/methacrylamide-propyl trimethylammonium chloride, acrylonitrile/acrylic acid/dimethylpropanediammonium acrylates sulfate terpolymer and mixtures thereof.

23. A gel composition as defined in claim 20, wherein said water swellable/soluble polymer mixture includes an anionic or nonionic polysaccharide polymer consisting essentially of gum tragacanth, sodium or propylene glycol alginate, Kappa-Iota or lambda-carrageenan, guar or hydroxyl propyl guar gum, karaya gum, gum arabic, locust bean gum, konjac mannan gum, gellan,

5 xanthan, succinoglycan or its acidic or enzymatic hydrolysates, sodium carboxymethyl cellulose, methycellulose, hydroxyethylcellulose, hydroxypropylmethylcellulose, hydroxypropylcellulose and mixtures thereof.

24. A gel composition as defined in claim 20, wherein said water swellable/soluble polymer includes a hydrophobically modified polymer consisting essentially of alkyl and/or aryl substituted hydroxyethylcellulose, lauryl dimethyl ammonium substituted epoxide of hydroxyethylcellulose, propoxylated cellulosic, xanthan, succinoglycan, or polygalactomannoses, 5 alkyl methacrylates/crosslinked acrylic acid copolymer, acrylonitrile/acrylates block copolymer and mixtures thereof.

25. A gel composition as defined in claim 1, wherein the weight ratio of cationic polymers to anionic and nonionic polymers in said gel composition is about 0.001:10 to about 5:1.

26. A gel composition as defined in claim 1, wherein the weight ratio of cationic polymers to anionic and nonionic polymers in said gel composition is about 0.001:10 to about 3:2.

27. A gel composition as defined in claim 1, wherein the weight ratio of anionic and nonionic polymers to hydrophobically modified anionic and nonionic polymers in said gel composition is about 1:5 to about 8:1.

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US97/08984

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :C11D 1/02, 1/83, 1/831, 1/94, 3/37

US CL :510/135, 121, 158, 336, 475, 476, 477, 462, 471, 403, 221, 280

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 510/135, 121, 158, 336, 475, 476, 477, 462, 471, 403, 221, 280

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS, CAS ONLINE

search terms: gel, acidic, gum

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,409,630 A (LYSY et al) 25 April 1995; col. 3, lines 33-41; and col. 3, line 52, through col. 7, line 56; and col. 8, lines 20-65	1-27
Y	US 5,456,863 A (BERGMANN) 10 October 1995; col. 10, line 10, through col. 17, line 61; col. 20, line 54, through col. 21, line 37; and col. 23, lines 25-42	1-27
A,P	US 5,597,791 A (RICHARDS ET AL) 28 January 1997	
A	US 5,004,598 A (LOCHHEAD et al) 02 April 1991	
A	US 4,851,149 A (CARANDANG) 25 July 1989	

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

Special categories of cited documents:	
*A* document defining the general state of the art which is not considered to be of particular relevance	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*E* earlier document published on or after the international filing date	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
*O* document referring to an oral disclosure, use, exhibition or other means	*Z* document member of the same patent family
*P* document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 08 JULY 1997	Date of mailing of the international search report 25 SEP 1997
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer DOUGLAS J. MCGINTY Telephone No. (703) 308-0661

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US97/08984

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,375,421 A (RUBIN et al) 01 March 1983	
A	US 3,996,152 A (EDWARDS et al) 07 December 1976	
A	US 3,635,835 A (PETERSON) 18 January 1972	
A	Amjad, Zahid, et al., "Carbomer Resins: Past, Present and Future", Cosmetics & Tioletries, 107(5)(May 1992), 81-82	